

Silica Factsheet Draft

Workplace Air Quality

MSHA (Mining Safety and Health Administration) and OSHA (Occupational Safety and Health Administration) workplace air quality regulations were significantly strengthened in the 1980s. The hazards to workers in occupations with silica exposure in the U.S. have been reduced over the last twenty years and the incidence of such disease has declined. Under these regulations, miners must wear tight masks with high-efficiency particle filters (not paper masks)ⁱ or clean air must be pumped into the work site.

NIOSH (OSHA's research branch) has concluded, however, that current standards are not only outdated, but inadequate and dangerous. Beginning in 2009 it began revising its workplace silica standards.ⁱⁱ They are currently under review at the OMB, the last step before they are officially promulgated.ⁱⁱⁱ

“According to the SBREFA report on the draft OSHA silica rule, reducing silica exposure to the National Institute for Occupational Safety and Health (NIOSH) recommended level of 50mg/cubic meter would prevent 60 worker deaths a year— 41 from silicosis and 19 from lung cancer. Hundreds of cases of non-fatal silicosis would also be prevented annually. In the ten years OSHA has been working on the silica rule, 600 workers have died because of the agency’s failure to act. Every week that passes, another worker becomes so sick from exposure to silica that they will eventually die. We cannot afford to further delay regulating silica exposure by imposing additional requirements on the OSHA rule making process.”^{iv}

The data suggests that current MSHA and OSHA regulation of miners’ exposure to silica remains inadequate. Silica exposure continues to pose a significant health concern for workers at sand mine sites. Enforcement of the regulations currently on the books has also been erratic and needs to be improved for all types of mining.

Ambient Air Quality

For those of us who will not be working as miners, the silica hazard we need to be most concerned about with frac sand mining in Prairie Farm is fine (respirable) crystalline silica in the ambient air, the degradation of air quality beyond the immediate work site.

Fine crystalline silica is generated by mechanical sand mining with earth movers, by drilling rock, from the use of explosives in rock, from wind blowing across acres of sand piles containing fine crystalline silica, and from fine crystalline silica particles blowing out of loaded and empty trucks going in and out of a site.

Once airborne, fine crystalline silica may stay aloft for three to four days and travel ten to fifteen miles downwind.^v Current federal and state regulations do not regulate ambient air quality as strictly as workplace air quality, though the situation was improved somewhat by more strict EPA National Ambient Air Quality Standards (NAAQS) issued in 2006.

The consensus view for some years has been that there is little risk to the general population from ambient silica exposure. The lax regulation of ambient air quality leads us to wonder how the fine crystalline silica that everyone agrees is so hazardous to mine workers suddenly becomes less hazardous once it leaves the work site and permeates the air of the surrounding area. Those who live nearby are unavoidably exposed to fine crystalline silica 24 hours a day, 365 days a year.

Recent research has strongly challenged this prevailing consensus and established that ambient exposure to silica of those downwind of peak sites such as quarries and sand mines can be very high and has produced multiple documented cases of silicosis.^{vi} *These risks are even further heightened for more vulnerable groups such as children.*^{vii}

Note on Terminology

Fine crystalline silica is not just sand. We should avoid referring to it as sand. Fine crystalline silica is made up of very tiny, hazardous, jagged crystals produced by the disruption of sandstone in the sand mining process through blasting, bumping, and shoveling. Conventional sand may have a wide range of silica content from high to low. Conventional sand is generally made up of much larger particles. The very fine particles referred to as fine crystalline silica are a narrow and specific subset of the nearly infinite number of compounds that contain silica.

Fine Crystalline Silica

Excluding toxic chemicals used in wet processing frac sand, fine crystalline silica is the material of greatest concern to which the public is exposed by frac sand mining operations. When explosives or machinery are used to release sand from rock, the cement holding the sandstone formation together is pulverized and blown into the air as fine crystalline silica.

The fine crystalline silica produced by mining activity is the small, jagged and hazardous variety of silica.

County mining documents and officials so far contradict themselves on the point of whether or not explosives will be used in currently proposed Prairie Farm mining projects. Because Prairie Farm is unzoned, ProCore is not legally required to publicly reveal, explain, or defend the adequacy of its operational procedures. Mechanical removal of sand with earthmovers produces newly fractured fine crystalline silica. Fine crystalline silica exposure will be a matter of public concern whether the sand is removed with earth movers as stated in the permit or with explosives through “bumping,” as suggested by a county official.

Terminology

Fine crystalline silica is commonly referred to as “silica dust.” I think we should avoid using this term. That phrase makes it too easy for mining proponents to pretend that silica dust is basically the same thing as house dust or the dust raised by farming. I suggest that we use the term “fine crystalline silica.” Farming dust includes silica particles of two types (amorphous and crystalline). Amorphous silica

is not hazardous. Even the crystalline silica particles in farm dust are less jagged and less dangerous to your health than fine crystalline silica.^{viii} *Farm dust and fine crystalline silica are not the same thing.*

From the perspective of exposure, we must also keep in mind that farmers only plow their fields a few times a year. Frac sand mining likely involves the production of fine crystalline silica with explosives or shovels most of the year and almost certainly involves the production of fine crystalline silica 24 hours a day, 365 days a year absent regulation of mining activity by the township through an ordinance or adoption of country zoning, at least one of which will be necessary to make a developer's agreement legally enforceable.

Particulate Matter

PM= Particulate matter
 >PM10= particles larger than 10 microns in diameter
 <PM10= particles smaller than 10 microns in diameter
 <PM4= particles smaller than 4 microns in diameter
 <PM2.5= particles smaller than 2.5 microns in diameter

>PM10 is visible and largely settles in the nose and throat.

<PM10 particles are invisible. They penetrate deep into the chest and may be pulled into most of the lungs.

<PM2.5 will permeate even the farthest reaches of the lungs and poses the greatest risk of health complications. *The form of silica that is most hazardous to health is fine crystalline silica <PM2.5.* This is the kind of silica produced by shoveling, drilling in rock, and by the use of explosives in mining.

Fine Crystalline Silica and Human Health

- Increased rates of asthma, emphysema, chronic obstructive pulmonary (lung) disease, chronic bronchitis, and scleroderma.^{ix}
- Silicosis from chronic exposure over a period of years. Silicosis scars the lungs in a manner similar to scarring from asbestos exposure (asbestosis). Silicosis persists as a chronic immune-inflammatory response. Symptoms include shortness of breath, swelling and scarring of the lymph nodes, and eventual death.

People suffering from silicosis are at greater risk for tuberculosis.^x The symptoms of silicosis may not appear for many years after exposure takes place. There is no cure. The complications of silicosis are often as serious as the condition itself. Half of all fatalities related to silicosis involve at least one other major health issue.

- Lung cancer. Based on exhaustive research, the International Agency for Research on Cancer (IARC) and the National Toxicology Program classified respirable crystalline silica (<PM₄) as a carcinogen, a cancer-causing substance. American medical institutions recognize it as a risk factor commonly associated with lung cancer that may quadruple one's chances of cancer.^{xi} The Wisconsin DNR's 2010 study of silica regulation acknowledged silica's status as a carcinogen, but declines to regulate it due to a purported lack of historical information on and consistent monitoring of the production of fine crystalline silica in Wisconsin.^{xii}
- All of the documented effects of silica exposure vary according to the percent of silica in ambient air. *Sandstone, the rock in the Prairie Farm area that will be mined for sand, has the highest known percent of silica, ranging from 90%-100% silica content^{xiii}. It will therefore produce fine crystalline silica of the most hazardous possible kind.*

Regulation of Ambient Air Quality

EPA

Silica Exposure Standard

While at least five states regulate silica exposure, *the EPA has not established a national standard for exposure to fine crystalline silica.* Wisconsin is not one of the five states. All of the documented effects of silica exposure vary according to the percent of silica in ambient air. The rock in the Prairie Farm area that will be mined for sand is largely sandstone. *Sandstone has the highest known percent of silica, ranging from 90%-100% silica content.*

Regulation of Ambient Small Particulates

The EPA has established a particulate matter <PM₁₀ standard without regard to silica content. This is called the NAAQS (National Ambient Air Quality Standard). The NAAQS allows for a maximum average exposure of 150mg<PM₁₀/cubic meter over a 24-hour period.

There is voluminous research establishing that the more particles this size in the air, the worse public health will be. In their 1996 study of ambient exposure to crystalline silica, the EPA argued that ambient exposure to fine crystalline silica will not be a health hazard if general air quality meets this EPA standard for all particulates.^{xiv}

There are two problems with the 1996 EPA position as institutionalized in Wisconsin:

1. The DNR's current air quality monitors implementing this policy in Wisconsin are spread many miles apart (50-100miles) from one another. They are consequently worthless for the purpose of monitoring small particle pollution at specific peak sites absent the installation of monitors both in and around specific sites. The original program also lacks a progress assessment component according to the Office of Management and Budget.
2. The NAAQS standard makes no allowance for the type or size of the particles being measured under the <PM10 threshold. For example, high levels of amorphous silica in this range, as often found in farming dust, are not particularly problematic. Similar levels of freshly fractured, fine crystalline silica (<PM2.5) produced by mining are very hazardous. This standard takes no account of the makeup and size of the particles below 10 microns (<PM10).

In 1997, the EPA itself acknowledged the validity of some of these concerns by setting a separate <PM2.5 standard. The <PM2.5 standard and the <PM10 standard were both adjusted in 2006. The cumulative annual <PM10 standard was dropped from the regulations while the 24 hr exposure limits were retained.

“The 2006 standards tighten the 24-hour fine particle standard from 65 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) to 35 $\mu\text{g}/\text{m}^3$, and retain the current annual fine particle standard at 15 $\mu\text{g}/\text{m}^3$. EPA has decided to retain the existing 24-hour PM_{10} standard of 150 $\mu\text{g}/\text{m}^3$. Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the Agency has revoked the annual PM_{10} standard.”^{xv}

An additional concern with the EPA NAAQS standard is that they not only allow five years for compliance, they allow additional extensions beyond that five years for areas formally designated as non-compliant. These exceptions effectively suspend the regulations for many years beyond their initial target date for implementation. Even the initial extensions were supposed to have run their course by 2010 at which time the new regulations were supposed to be in effect and enforced.

DNR

The DNR does not currently collect data on silica emissions in Wisconsin. A commission to study silica exposure was mandated in 2006, but was not undertaken until 2009, purportedly due to budget cuts. The recent status report on DNR's silica study points to <PM4 size particles as a recognized source of silicosis and lung cancer^{xvi}, but current DNR practice does not utilize this established consensus as the study has not been adopted as a formal finding of the DNR.

The state of California has adopted an exposure limit standard of 3mg fine crystalline silica/cubic meter. The DNR estimates the Chippewa Falls mine will generate 4mg fine crystalline silica/cubic meter.^{xvii} The DNR permitting process excludes vast quantities of small particle pollutants under the category of “fugitive”

dust, that is dust that comes from anywhere other than a smokestack.^{xviii} “Fugitive” dust is generally unregulated under current DNR protocol.

There are three regional exceptions to this rule: sections of Beloit, sections of Milwaukee, and sections of Waukesha. *Fugitive dust is regulated and monitored in these three exceptional areas.*^{xix} Within these areas, fugitive dust exposure is limited to 1mg/cubic meter or a maximum 24 hour concentration of 5mg/cubic meter and very detailed and specific guidelines for handling potential sources are outlined.

Operators of ledge rock quarries and industrial sand mines, on the other hand, are required to submit a fugitive dust control plan, but they are not subject to the fugitive dust control limits enforced in Beloit, Milwaukee, and Waukesha.^{xx} There is also a requirement for an ambient air monitoring plan, again not subject to the quantitative emission limits in force in Beloit, Milwaukee, and Waukesha.^{xxi} It is also within the power of the DNR to grant a variance to the monitoring requirement if they feel the operator has established that the general public will not be exposed to “significant levels” of particulate matter and that the sources are controlled to a level that meets all requirements.^{xxii}

The DNR does not currently regulate fine crystalline silica emissions. *This means that predictable emissions in Prairie Farm will likely exceed the Texas and California standards.* In other words, the DNR regulates workers’ exposure to fine crystalline silica, but does not effectively monitor or regulate fine crystalline silica produced by mining operations, that is to say, it does not monitor fine crystalline silica in the neighborhood of the mine.

In issuing mining permits in Chippewa Falls, the DNR repeated the logic of the EPA’s 1996 NAAQS standard when it took up levels of <PM10 as the only relevant air quality standard. That means through the course of the permitting process the DNR appears to have simply ignored changes in EPA standards since 1996, despite legislation requiring that state standards meet but not exceed national standards established by the EPA. The DNR’s permitting process thus continues the shortcomings of the 1996 EPA standards—they fail to distinguish between less dangerous materials near 10 microns in size from much smaller and more hazardous particles such as fine crystalline silica that are <PM3 or <PM2.5.

On June 27, 2011, the DNR moved to repeal the Wisconsin state limit on exposure to total suspended particulates (TSP). The DNR argues that the EPA’s NAAQS standards for <PM10 and <PM2.5 remain in place so the TSP standard is redundant and confusing. It seems that there is some merit to this argument. *Unfortunately, the DNR refused to engage the very <PM2.5 EPA standard it claims supercedes the TSP in its permitting of Chippewa Falls mining sites.* More recent mining permits issued by DNR finally have reportedly acknowledged the legal force of the EPA’s <PM2.5 ambient air quality standard promulgated in 2006.^{xxiii}

Given the exemption that Wisconsin statutes and the DNR grant for fugitive dust emissions everywhere outside of Beloit, Milwaukee, and Waukesha, it can reasonably be argued that to date the DNR has not required good faith monitoring or enforcement of the EPA’s ambient air quality standards. *The fugitive dust*

exemption effectively subverts the intent of the regulation by refusing to count most particles produced by mining operations as particles subject to EPA regulation.

Fugitive dust is any dust that does not come out of a smokestack. Sand mines don't have smokestacks, though processing plants may.

There are three urban exceptions to the watered-down Wisconsin DNR rules for particulates that have some teeth, Beloit, Milwaukee, and Waukesha. At some point, we may want to campaign for expanding those exceptional rules regulating fugitive dust emissions to the rest of the state.

The Human and Financial Cost of Regulative Obstruction

Pro-mining industry lobby groups such as the Great Lakes Legal Foundation, the Wisconsin Civil Justice Council, and Hamilton Consulting Services actively promote the claim that Wisconsin policy agencies are too quick to issue regulations and that they do so without regard to the impact of regulations on the Wisconsin and U.S. economy. **Sadly, in many cases the current Wisconsin and U.S. system is characterized by exactly the opposite problem: long delays before needed regulations are issued—often at substantial cost in lives and monetary costs to industry and the public.**

The Wisconsin DNR has delayed a silica study of its own for over five years. That study was revived last year. A status report on the study in December 2010 acknowledged the broad and deep medical consensus that fine crystalline silica causes lung cancer, silicosis, and multiple respiratory and auto-immune disorders. The DNR spent twelve months producing a new report declaring there is limited information available on the subject and it should be further researched.

One of the core claims of the status report was that no historical data monitoring silica exposure in Wisconsin is available. *It appears that the DNR could not trouble itself to begin such monitoring at any point during its purported "study."* **It is possible that the current Wisconsin statutes and the DNR's current non-metallic mining permitting standards violate the EPA's National Ambient Air Quality Standards (NAAQS) by excluding the vast majority of industrial mining particles from regulation under the category of "fugitive dust," despite Wisconsin law mandating that DNR policies harmonize with EPA requirements.**^{xxiv} The citizens of Wisconsin cannot afford further delays in regulating silica exposure by imposing additional requirements on the OSHA, EPA, or DNR rule-making processes.

In 2005, lobbyists in Texas successfully passed "tort reform" legislation effectively precluding legal recourse for tens of thousands of documented victims of asbestos and silica exposure by defining those not in extremely late stages of disease or lacking malignant tumors as "healthy" and promoting the blanket accusation that anyone who refused to file a case under punitive new rules making such cases economically irrational and impossible to legally document were obvious frauds caught out as attempted perpetrators of frivolous lawsuits.

This is what industry means when they say that "tort reform" must appeal to scientific standards. *Any victims who can't document specific weekly or daily dosages of silica to which they were exposed over the course of decades have their cases thrown out of court.* Such legal "standards" are transparently punitive and indifferent to the

very real public health concerns of silica and asbestos exposure victims or to any credible interest in legal or economic justice.

Wisconsin Gov. Scott Walker has already signed a Wisconsin version of “tort reform.” We may logically expect a similar assault on the legal rights of silica exposure victims in Wisconsin courts in the very immediate future if such efforts are not already underway.

Pro-sand Mining Disinformation

Claim #1:

“Prairie Farm doesn’t need a town ordinance or county zoning in order to be protected from the hazards of fine crystalline silica produced by sand mining because state and federal laws are already in place and have us covered.”

Reality:

In the state of Wisconsin, outside of three specific urban areas under special regulations, unzoned townships are charged with reviewing and licensing non-metallic mining operations. The only legal check point for a mining operation in an unzoned township is submission of a reclamation plan to relevant county authorities to meet the requirements of the prevailing non-metallic mining ordinance. Most of these issues concern what will happen after mining has ceased and have relatively little to do with the degree to which mining operations themselves may endanger air, water, and health while they are still underway.

Absent developer’s agreements, the operational plans of non-metallic mining companies need not be revealed to the public as they are not legally considered part of a reclamation plan. The DNR is legally required to enforce EPA standards for ambient air quality at <PM10 and <PM2.5, but it will not have any data upon which to enforce these standards unless the township forces the mining company to install multiple air quality monitors both on and off the site, including detailed mapping of the downwind plume of fine crystalline silica.

Despite the dangerous loopholes in Wisconsin environmental protection law and its apparent failure to enforce EPA standards, unzoned townships are likely preempted from regulating air quality as that falls under the purview of the DNR, even though the DNR and its enabling statutes have effectively subverted the intent of the EPA ambient air quality standards with the invention of a category of dust particles that shall not be treated as dust particles. Townships should attempt to bargain for air quality standards and monitoring in negotiating developer’s agreements, but a township may not presume to have the legal authority to license or require them as that will be challenged in court and will likely be struck down as improperly attempting to usurp DNR authority. This unfortunately reduces a township’s negotiating leverage despite the lack of clarity and consistency in Wisconsin statutes and in the DNR’s enforcement of them.

Air quality monitoring at sand mining sites is left in a strange sort of regulatory purgatory. By law it must be discussed, but there is no clear standard that monitoring of fugitive dust is required to meet so the point of the exercise quickly becomes very unclear. University of Wisconsin academics familiar with these concerns will be meeting with the chair of the DNR board shortly to express these concerns and to

encourage the DNR to exercise its authority to regulate all forms of particle emissions more consistently and with greater attention to and concern for the impact of such defacto deregulation on the public health of Wisconsin citizens.

In previous developer's agreements mining companies have consistently fought to reduce the number of air quality monitors and the DNR has regularly agreed, a decision that clearly puts business considerations before public health. Mining companies have insisted on air quality monitors upwind rather than downwind of mining sites so they are effectively useless. The DNR requires that the topic of air monitoring be raised in the course of the non-metallic mining permitting process, but does not mandate monitoring. *Such monitors are consistently opposed by mining companies because it will be difficult for them to meet the ambient air quality laws already on the books if they are properly enforced* and because it raises the potential of interfering with operations and reducing profits. *Even in the event such monitoring takes place as a result of a developer's agreement, Wisconsin laws have been capriciously written such that a majority of the particles produced on a mining site—any dust not produced by a smokestack—is classified as “fugitive dust” and do not count as a violation of the EPA standard.* The DNR now ignores fugitive dust levels in its permitting review process. The status of its air monitoring discussion is entirely subject to the discretion of the particular personnel handling the particular permit as there are no clear fugitive dust standards that such air monitoring is legally required by the DNR to meet. Whether Wisconsin statutes effectively enabling evasion of EPA standards actually meet the requirements of governing state and federal law is an interesting question that deserves careful examination.

Lastly, a separate silica exposure standard is necessary to ensure that the silica content of particles in the air is not so high that even air that meets EPA particle standards for ambient air is not hazardous, causing cancer, auto-immune diseases, and aggravating the condition of asthma sufferers, especially in children. The sand mines in Barron County are extracting sand from sandstone, a rock with a 90%-100% silica content, the most hazardous source of fine crystalline silica possible. *It defies medical science to insist that we are safe if generic particles are monitored but we don't collect and regulate fine crystalline silica that the DNR itself now classifies as a carcinogen.* The DNR's silica status report of 2010 ran out the clock and refused to draw or adopt any conclusions after a year of study, four years after they were required to address the matter by statute.

We recommend the Texas silica exposure standard of .027mg/cubic meter or the California silica exposure standard of .03mg/cubic meter as part of any ordinance or developer's agreement in Prairie Farm. These standards are grounded in the latest scientific and medical literature, standards the DNR's own data support but which the state of Wisconsin currently lacks the political will to adopt as law. OSHA has drawn up a new silica standard, but it remains bottled up in an extended OMB review so even worker safety at sand mines is not assured under current federal and state law.

Claim #2:

“Farming stirs up dust with lots of silica compounds. We can't regulate silica dust from the mines without outlawing farming.”

Reality:

I personally heard this wildly misleading falsehood come out of the mouth of a Barron County official. Farming does produce a lot of particles and most soil and sand includes some form of silica. However, only a fraction of farm dust is crystalline silica. Even the crystalline silica produced on a farm differs from the fine crystalline silica produced by mining because it is weathered and is therefore less jagged and hazardous to human health.^{xxv} Farm dust is very different from the fine crystalline silica produced by sand mining. Farmers only plow their fields a few times a year. Industrial mining produces these particles every hour of every day of the year absent regulations requiring them to act otherwise. **In addition, new zoning or monitoring standards for fine crystalline silica can easily be written to grandfather in traditional farming activities.** This talking point is wrong on the facts, wrong on the science, and wrong on the law.

Claim #3:

“Prairie Farm doesn’t need a town ordinance to regulate silica because the representative of ProCore, a transnational corporation that refuses to identify itself, is a good guy who can be personally trusted.”

Reality:

While the suggestion that the representative of a corporation that refuses to disclose its identity or track record may be trusted is arguably laughable on its face, even if the representative of this one company could be trusted, that doesn’t give us anything. ProCore is a corporation and they don’t need to consult the representative they have hired for Prairie Farm in order to change any plans that their point man may have represented to the town board in all sincerity. Indeed, his contract could be terminated tomorrow. Because ProCore is a corporation and not a person, they can change their policy on anything they desire and it will have no connection whatsoever to the character of the representative they currently have under contract.

Secondly, the anonymous corporation ProCore represents is not the entirety of the mining industry. There will predictably be dozens of mining companies applying for permits to open non-metallic mines in the Prairie Farm area in the near future and a developer’s agreement with one company and no mechanism for enforcement will not only be ineffective in itself, it won’t mean a thing to any of the other mining companies to come. Adoption of an ordinance and/or county zoning will mean we have planned for the future and will have already established prevailing standards when other mining companies come to call. Failing to do so will mean the town board will once again be in over its head and the anarchic chaos of the last six months will have to once again be repeated tenfold. I think we all have better things to do with our time.

Claim #4:

“Operation of the Prairie Farm mining sites announced so far will not involve blasting.”

Reality:

At the meeting where the reclamation plans for the Bruder properties were made public, county officials repeatedly and categorically denied that blasting will take place at the Prairie Farm sites. Private conversation with one of them revealed they were not using the dictionary definition of blasting, the use of explosives to extract material from rock. They are quibbling about the specific manner in which explosives will be used at the sites. Their preferred term for the use of explosives at Prairie Farm sand mines is "bumping." "Bumping" purportedly uses smaller amounts of explosives per explosion. We need to investigate exactly how small "smaller" is.

The fact remains that operation of the Prairie Farm mines will consistently produce fine crystalline silica with either mechanical removal or explosives, but the inability of county officials to get their story straight on this (the reclamation permit explicitly states sand will be removed by mechanical means) does not encourage confidence in the process or the result. As Prairie Farm is unzoned, ProCore is not legally required to reveal operational plans. The public will remain in the dark on this point unless and until a local ordinance or county zoning is adopted in Prairie Farm or a developer's agreement requires periodically reviewed and legally enforceable disclosure and regulation of operational plans. A gentlemen's agreement to be a good citizen absent a clear procedure for review and enforcement will be completely meaningless from the perspective of regulation. But it would run out the clock, allowing the mining company to establish a status quo that cannot be reversed later on. It will also effectively throw away the only tools we have at our disposal, township authority to regulate by way of an ordinance and township ability to adopt county zoning and require any and all mining companies to meet a bare minimum of standard, legislated check points concerning public safety and the protection of the rights of property owners in the area from devaluation of their equity by the actions of others on neighboring property.

Air Quality Regulations Reference**Regulations on Workplace Exposure to Silica Dust**

MSHA

Recommended exposure limit in coal mines

.1mg/cubic meter

NIOSH (National Institute of Occupational and Safety and Health (1990))

Recommended exposure limit for occupational exposure as a TWA over a 10 hr shift

.05mg/cubic meter

OSHA

PEL

10mg/cubic meter

% silicon dioxide + 2.

Regulations on Ambient Exposure to Particulate Matter

EPA National Ambient Air Quality Standard

Particulate Matter

(<10 µm) 150 µg/cubic meter as a 24 hr average

Code of Federal standard (24-h average); Regulations (1991)

50 µg/cubic meter (annual arithmetic mean)

ⁱ “High-efficiency particulate filters on tight-fitting masks are needed in order to remove the fine respirable dust from the inhaled air. A simple paper mask is not sufficient.”

G.S. Davis, “Silicosis,” in *Occupational Diseases*, Elsevier Ltd., (2006), p.234.

ⁱⁱ <http://ohsonline.com/articles/2011/05/19/comprehensive-silica-health-standard-coming-soon-oshas-chief-says.aspx?admgarea=news>

ⁱⁱⁱ Hammock, Brad. “OSHA’s Crystalline Silica Rule at OMB for Review,” <http://www.oshalawblog.com/2011/02/articles/osha-rulemaking/oshas-crystalline-silica-rule-at-omb-for-review/>

^{iv} “The Cost of Regulatory Delay,” compiled by Demos, June 23, 2011, p.5.

^v “The atmospheric residence time of fine particles in the lower troposphere can be three to four days (Husar 2003) and may travel several tens of kilometers downwind. The particles tend to be removed by wet deposition. Additionally, crystalline silica particles tend to be inert and can re-suspend following deposition (Husar 2003).”

Bridge, Ian. “Crystalline Silica: A review of dose response relationship and environmental risk,” *Air Quality and Climate Change* 2009, vol.43, p.12.

^{vi} Bridge, Ian. *Ibid.*, p.16.

^{vii} “A health based environmental exposure standard should incorporate protection of sensitive subgroups within the human population (such as children) (WHO 2006, NHMRC 2006, DEH 2007). WHO 2006 state: ‘...new data and methodologies have emerged, indicating that children are a vulnerable population subgroup with special susceptibilities and unique exposures to environmental factors that have important implications for public health practices and risk assessment approaches....’ NHMRC (2006) provides further support for the inclusion of children as a specific subgroup for protection within an ambient air quality standard, stating (p45): ‘...For example, children may be considered a sensitive sub-population because any irreversible effects may influence their health throughout their entire life...’ Furthermore, a review of ambient air quality and children’s health conducted by the DEH (2007) identified that infants and children inhale and retain larger amounts of air

pollutants than adults, have developing immune systems and therefore cannot detoxify and excrete toxins as well as do adults.”

Bridge, *Ibid.*, p.13.

viii Castronova, Vincent. “The Role of Freshly Fractured Silica in Acute Silicosis,” *Silica*, v.1, p.4.

ix Parks, Conrad, Cooper, “Occupational Exposure to Crystalline Silica and Autoimmune Disease,” *Environmental Health Perspectives Supplements*, v.107, Number S5, October 1999, pp.3-5.

x Texas Silica, LLC, MSDS—Material Safety Data Sheet, pp.1, 5.

xi Davis, “Silicosis,” p.233.

xii “A recurring theme from the literature review and survey is that very little conclusive information exists regarding sources, controls or levels of silica present in ambient air. Because this is a new issue for Wisconsin, this lack of data means it is not currently possible to determine conclusively whether or to what extent the quantity, duration or types of silica emissions in the state may, indeed, be a public health concern. It would take significant additional efforts to fill in these data gaps.” WDNR Silica Study Status Report, p.4.

xiii Sandler, Howard, M.D. “OSHA’s Proposed Silica Standard,” p.5, <http://www.esafetyline.com/eei/conference%20pdf%20files/EEI%20Fall%2009/OSHA%20Proposed%20Silica%20Std%20Sandler.pdf>

xiv EPA Study of Silica Emissions, 1996, p.30.

“Mining environments generally are considered more hazardous (i.e., more freshly fractured dust, finer particles, more peak exposures) than ambient environmental exposure to silica. The analysis in Chapter 7 indicates, however, that, even if a comparable ambient environment is assumed, the risk of silicosis to an otherwise healthy population continuously exposed for 70 years to the highest silica levels anticipated under the EPA National Ambient Air Quality Standards (NAAQS) for particulate matter (an estimated cumulative silica exposure of approximately 1 mg/m³ Å~ years) would be less than 1%.”

xv EPA 2006 Standards Revision, <http://www.epa.gov/pm/naaqrev2006.html>

xvi WDNR Silica Study Status Report, p.9.

xvii Crispin Pierce, *Health Risks from Frac Sand* Powerpoint, p.22.

xviii “‘Fugitive dust’ means solid airborne particles emitted from any source other than a flue or stack.” DNR Chapter NR 415.02.2, p.89.

^{xix} NR 415.035.a-c, p.89.

^{xx} NR 415.075

^{xxi} NR 415.075.4, p.93.

^{xxii} NR 415.075.4.b, p.93.

^{xxiii} Personal conversation with Prof. Crispin Pierce, Associate Professor of Environmental Public Health, University of Wisconsin, Eau-Claire.

^{xxiv} I have seen this statute in writing, but I can't track it down at the moment.

^{xxv} Very high concentrations of inorganic dusts are generated by field activities such as plowing, tilling, haying, and harvesting. The bulk of the inorganic dusts are silicates. These include crystalline silica (silica) and non-crystalline amorphous silica (diatomite).^{xxv}

Environmental Health Perspectives, Supplements 108, Number S4, August 2000, "Agricultural Lung Diseases."

Furthermore, *the weathering effects upon respirable quartz dusts generated by agriculture are considered to be less pathogenic than the freshly fractured quartz dust generated by industrial processes such as mining, quarrying, and sandblasting.* Diatomaceous silicate inorganic dusts are also considered to have relatively nontoxic pulmonary properties.

Ibid., see also American Thoracic Society. Respiratory health hazards in agriculture. Am J Respir Crit Care Med 158:S1-S76 (1998).